

Strawberry Runner Suppression with Prohexadione-Calcium

B.L. Black

Fruit Laboratory, Henry A. Wallace Beltsville Agricultural Research Center
Agricultural Research Service, U.S. Department of Agriculture
Beltsville, MD 20705-2350
USA

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Abstract

Foliar applications of the gibberellin synthesis inhibitor prohexadione-Ca (P-Ca) were tested for suppressing runners of cold-stored dormant plants of the day-neutral cultivars Seascape and Selva in a spring-planted production system. P-Ca was applied as a foliar spray at an active ingredient concentration of 240 mg/L, either as a single application, or twice at a 1-week interval just after pre-initiated flower bloom. P-Ca treatments reduced runner number by 50% when applied either singly or in multiple applications, and resulted in an increase in crown number. Although yields for 'Selva' were increased by P-Ca treatment, all treatments yielded below commercially acceptable levels during 2003.

INTRODUCTION

Commercial strawberry propagation and fruit production require careful balancing of vegetative (branch crowns, stolons) and generative (flowers, fruit) growth (Darrow, 1929). In many situations, vegetative growth control can be accomplished by cultural methods, including the selection of nursery location by latitude and altitude, and by carefully orchestrating digging and transplanting dates to regulate the amount of chilling. However, in some production systems and regions these practices are impractical or impossible. In spring/summer-planted day neutral production systems, nursery plants must be cold stored for several months between digging and planting, resulting in vegetatively vigorous plants prone to excessive runner production. In the cold-climate annual hill production system practised in the mid-Atlantic region of the U.S., summer-planted plug plants can runner profusely, which delays branch crown formation.

Plant growth regulators may provide a means for chemical control of runners. Reekie and Hicklenton (2002) first noted that the gibberellin synthesis inhibitor, prohexadione-calcium (P-Ca), reduced runner number and length when applied to 'Camarosa' and 'Sweet Charlie' strawberry plants that had been cold stored. Previously, a number of other GA inhibitors were tested for strawberry runner suppression, with paclobutrazol being the most consistently effective (Archbold, 1986, 1989; McArthur and Eaton, 1987; Hasse et al., 1989; Deyton et al., 1991). However, this compound has yet to be registered in the U.S. for use on fruit crops, perhaps due to its long residual activity in the plant (Greene, 1986; Archbold, 1989), and a half-life in the soil of several months (Rademacher, 2000). In contrast, P-Ca is a short-acting inhibitor with a half-life in the soil of <7 days (Evans et al., 1999), and it has now been registered for use on bearing apple trees.

It was recently demonstrated that P-Ca is effective in reducing runners and advancing branch crowns of 'Chandler' plug plants in a cold climate annual hill system (Black, 2004). The objective of the present work was to evaluate P-Ca for suppressing runners of day-neutral plants in a spring-planted system.

MATERIALS AND METHODS

Bare-root dormant plants of 'Seascape' and 'Selva' were obtained from a commercial nursery and kept in refrigerated storage until planting on 2 April 2003. A research site was selected at the Beltsville Agricultural Research Center in Beltsville, Maryland (39° N

latitude), and prepared with raised beds, plastic mulch and sub-surface drip irrigation as previously described (Black et al., 2002). Beds were spaced 1.5 m on centres, and divided into 1.2 m-long plots that were assigned to one of four replications and eight treatments (Table 1). Plots were arranged in a randomized complete block design, with blocking by location in the field. Plants were placed in an offset double-row arrangement spaced 30 cm within and between rows, resulting in six plants per plot with a 60 cm buffer between plots.

The planting was fertilized at weekly intervals beginning 23 April, by injecting ammonium nitrate into the irrigation system at a rate of 8 kg N per fertilized ha. Blossoms were removed by hand at weekly intervals during May. A commercial formulation of prohexadione-Ca (Apogee®, BASF Corp.) was applied in a high-volume foliar spray at an active ingredient concentration of 240 mg/L. The single application was made on 30 May, two weeks after bloom of the pre-initiated flower buds. The repeat applications were made 30 May and 5 June. Comparison treatments were an untreated control and hand removal of runners.

Treatment effects were evaluated by counting runners at weekly intervals, by measuring fruit yield twice weekly, and counting late-season crown numbers. Data were analysed as a randomized complete block design using the GLM procedure of the SAS program package. Individual treatment means were compared using the PDIF option of the LSMEANS statement.

RESULTS AND DISCUSSION

Foliar applications of P-Ca at active ingredient concentration of 240 mg/L significantly reduced runner production in both cultivars, with suppression being more effective in 'Selva' than in 'Seascape' (Fig. 1). Runner suppression was less dramatic in this study than in previous experiments with summer-planted plugs of June-bearing cultivars Chandler and Allstar, where runner numbers were reduced by 57% to 93% (Black, 2004). P-Ca rates from 60 to 480 mg/L were tested on 'Chandler' with 240 mg/L giving the optimum response. Based on these results, the 240 mg/L rate was selected for this study. However, higher rates or more repeat applications may be required for cold-stored day neutral cultivars to give more complete runner suppression. A second P-Ca application after one week did not significantly increase runner suppression. Hand removal of runners apparently stimulated additional runner formation, as the hand removal treatment consistently produced more runners than the control.

Crown counts taken the week of 20 August 2003 indicated significant increases in branch crown development due to P-Ca application (Table 1). P-Ca also increased crown numbers of 'Chandler' plugs (Black, 2004). In the fall-planted annual hill system, inadequate crown development can limit yields the following spring. In this case, increased crown development is desirable. However, excessive crown branching can result in reduced fruit size and quality. It is unclear from our data whether P-Ca-induced increases in crown number would be beneficial or detrimental in a spring planted day-neutral production system.

Yield was significantly increased by P-Ca application in the case of 'Selva'. However, yield for all treatments was very low. The climate at the Beltsville research site is typically too warm for summer day-neutral strawberry production with daytime temperatures in June routinely exceeding 30°C. Although the 2003 season was unusually cool, frequent rain storms resulted in poor pollination and high levels of fruit rot. Total harvested yield in both day-neutral and June-bearing research plots was well below normal. Duval (2003) reported reduced or delayed fruiting after application of P-Ca to fresh-dug transplants in a winter production system. We did not see any delay in fruiting, but it is difficult to tell how yield might be affected in a commercial planting employing this system.

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Tables

Table 1. The effect of prohexadione-Ca on total yield (g/plant) and crown number of 'Seascape' and 'Selva' strawberry in a spring-planted production system. Fruit were harvested from 26 June to 7 August. Total crowns were counted in late August. For yield and crown number, the cultivar \times treatment interaction terms were not significant. Letters denote significant main effect differences across cultivar as determined by individual comparisons using the PDIFF option of the GLM procedure in SAS.

Treatment	Yield (g/plant)			Crown number (no./plant)		
	'Seascape'	'Selva'		'Seascape'	'Selva'	
No runner removal	192	65	b	4.87	4.10	c
Hand removal	210	74	ab	5.43	5.04	bc
P-Ca Single appl. (30 May)	216	128	a	6.03	6.03	b
P-Ca multiple appl. (30 May, 6 Jun)	228	124	ab	8.07	7.13	a

Figures

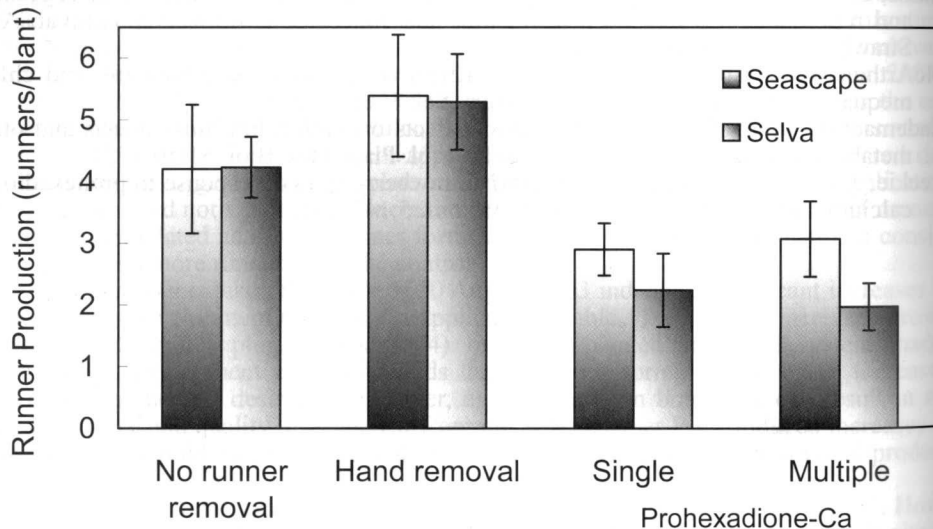


Fig. 1. The effect of foliar applications of prohexadione-Ca on runner formation of the day neutral cultivars Seascape and Selva in a spring planted production system.